Language Technology, Electronic Health Records, and the Clinical Narrative

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Electronic health records are a big deal.

"The Electronic Health Record (EHR) is a **longitudinal electronic record** of patient health information generated by one or more encounters in any care delivery setting. Included in this information are patient demographics, progress notes, problems, medications, vital signs, past medical history, immunizations, laboratory data, and radiology reports. . . ."

National Institutes of Health, National Center for Research Resources, "Electronic Health Records Overview"
http://www.ncrr.nih.gov/publications/informatics/ehr.pdf

In the United States there are on the order of 2,000,000,000 doctor-patient encounters per year; that's over 200,000 an hour.

On April 26, 2004, President Bush announced the goal of assuring that most Americans have EHRs within the next 10 years, i.e. in 2014.

http://www.ncbi.nlm.nih.gov/pmc/articles/PMC1550638/

The Health Information Technology for Economic and Clinical Health (HITECH) Act was passed in 2009. It authorizes expenditures of at least $20,000,000,000 to promote the adoption and use of EHR technologies.

http://itlaw.wikia.com/wiki/HITECH_Act

- Which decision is supported by the best evidence?
- How well does a proposed treatment work?
- Does drug effectiveness vary by patient population?
- Who are the good candidates for a clinical trial?
- Which caregivers are following best practices?
- Are more cost-effective options being overlooked?
- Are we seeing evidence of a new epidemic?
- Are we seeing evidence of a biological attack??
- ~~Are we seeing evidence of an alien invasion???~~

  Ok, maybe not that.

Those applications all require patient data that is suitable for analytics.

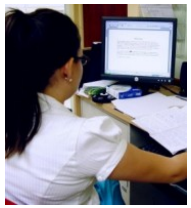
The obvious solution is to have healthcare providers *enter* patient data that is suitable for analytics.

Providers

Payers

CHIEF COMPLAINT:
Shortness of breath.
HPI: This is a 68-year-old female who presents to the emergency department with shortness of breath going for several days …

Coding Tools & Services



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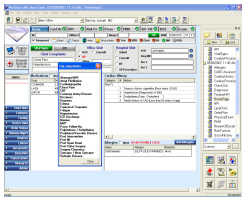
Providers

Payers



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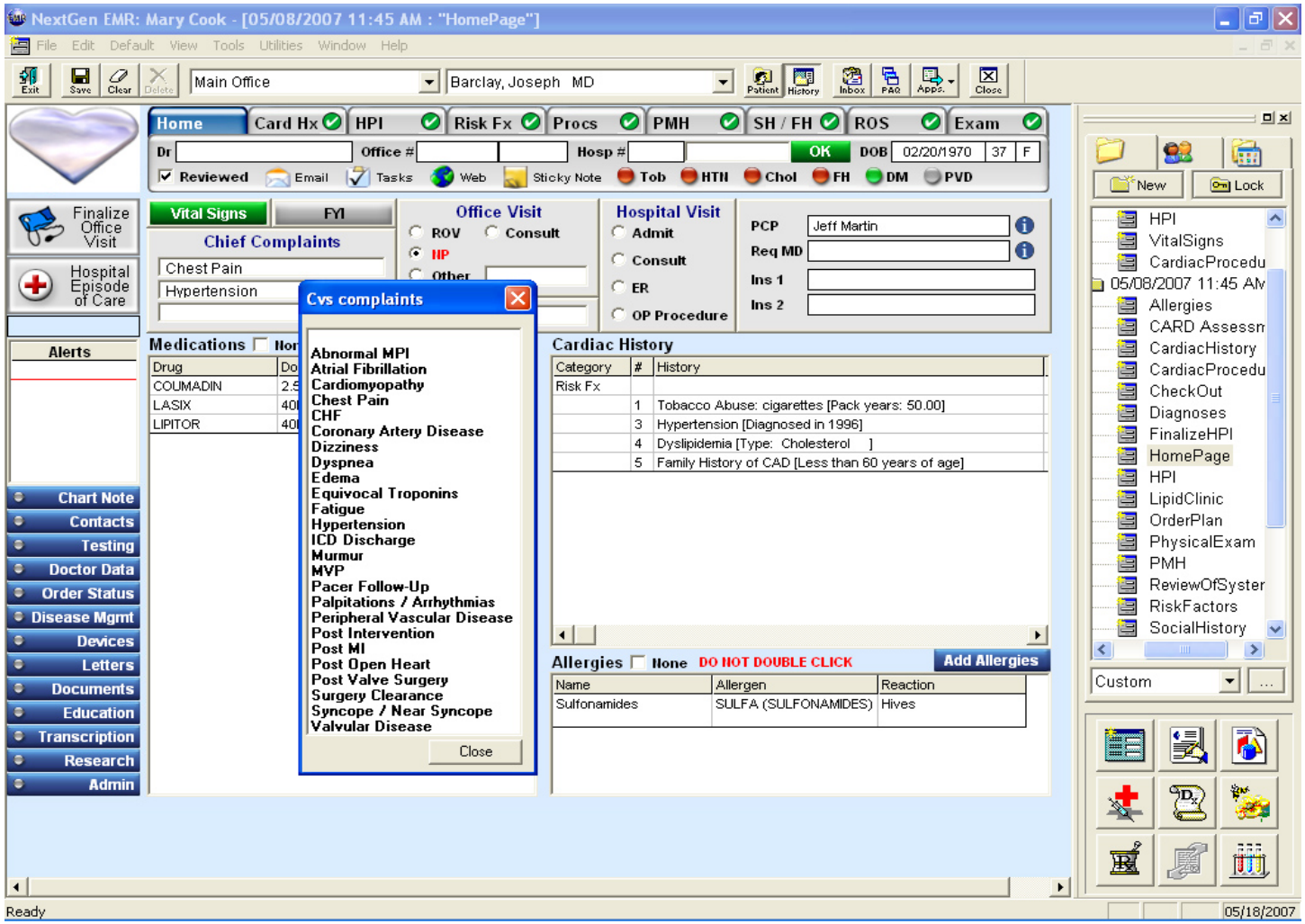

Source: http://www.nextgen.com/images/screenshots/card01.jpg

"This system is designed for physicians to point and click their way through an entire exam quickly and effortlessly." (EMR product review)

1 Tablet(s) PO Daily
1 tab by mouth or orally daily

1 tab orally every 24 hours.
1 tab(s) PO (oral) qDay

1 tab(s) orally once a day.

1 tabs QD
1.0 tab po qd
ONE TABLET; ORAL QD

One orally daily
One tablet po daily
TAKE 1 TABLET DAILY
TAKE ONE PO QD
Take 1 Tab by mouth daily.
Take 1 tab daily daily orally
Take 1 tab daily orally
Take 1 tab po qday
Take 1 tab qd po
Take 1 tab qday PO
Take 1 tab(s) daily orally

Take 1 tablet by mouth daily.
Take 1 tablet orally Daily

Take 1 tablet orally every day
Take one orally daily

Take one orally daily as discussede

Take one tablet by mouth daily
Take one tablet by mouth every day
Take one tablet daily

Take one tablet once per day orally
Take one tablet po qd
by mouth one po qd
one orally once a day
one orally per day
one tablet by mouth daily
one tablet daily
one tablet once a day
take 1 tab po daily
take 1 tab po qd
take one orally each day

But…

The path we are taking to EHRs threatens to disrupt or even do away with the natural use of language in clinical records.

And the language in clinical records is also a big deal.

The clinical narrative

"…In years past, a **well-written history and physical, or progress note, would unfold like a story**, giving a vivid description of the patient's symptoms and physical exam at the point of the encounter, as well as the synthesis of the data and the plan of care."

– "EMRs: Finding a balance between billing efficiency and patient care", Henry F. Smith, Jr., MD, Commentary, The Times Leader, Wilkes-Barre, PA, June 12, 2011.

April 14, 2007

CHIEF COMPLAINT: Shortness of breath.

HISTORY OF PRESENT ILLNESS: This 68-year-old female presents to the emergency department with shortness of breath that has gone on for 4-5 days, progressively getting worse. It comes on with any kind of activity whatsoever. She has had a nonproductive cough. She has not had any chest pain. She has had chills but no fever.

EMERGENCY DEPARTMENT COURSE: The patient was admitted. She has had intermittent episodes of severe dyspnea. Lungs were clear. These would mildly respond to breathing treatments and morphine. Her D-dimer was positive. We cannot scan her chest; therefore, a nuclear V/Q scan has been ordered. However, after consultation with Dr. C, it is felt that she is potentially too unstable to go for this. Given the positive D-dimer and her severe dyspnea, we have waved the risks and benefits of anticoagulation with her heme-positive stools. She states that she has been constipated lately and doing a lot of straining. Given the possibility of a PE, it was felt like anticoagulation was very important at this time period; therefore, she was anticoagulated. The patient will be admitted to the hospital under Dr. C.

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May 3, 2007

EMERGENCY DEPARTMENT COURSE: The patient was admitted and nontoxic in appearance. Blood pressure was brought down aggressively. With this combined with BiPAP, she has reversed her respiratory distress promptly. She has improved significantly. She will not require intubation at this time period. Her family has elected to go back to M, Dr. W. I did discuss this case with Dr. G who is on call for L Cardiology. She has accepted him in transfer; however, there are no PCU or ICU beds at this time period. Will admit here for a brief period until a bed is available at M. I discussed this case with Dr. R who will admit.

Clinicians were trying to determine whether the shortness of breath was due exclusively to her failing heart, or whether she has pneumonia.

Prompt response indicates that pneumonia is not the issue.

I worry that EMRs as implemented can actually downgrade the quality of information passed between health care teams

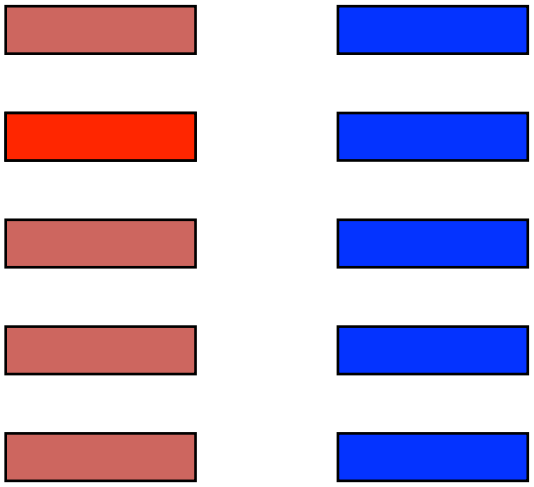
– Henry F. Smith, Jr., MD, “EMRs: Finding a balance between billing efficiency and patient care", Commentary, The Times Leader, Wilkes-Barre, PA, June 12, 2011.

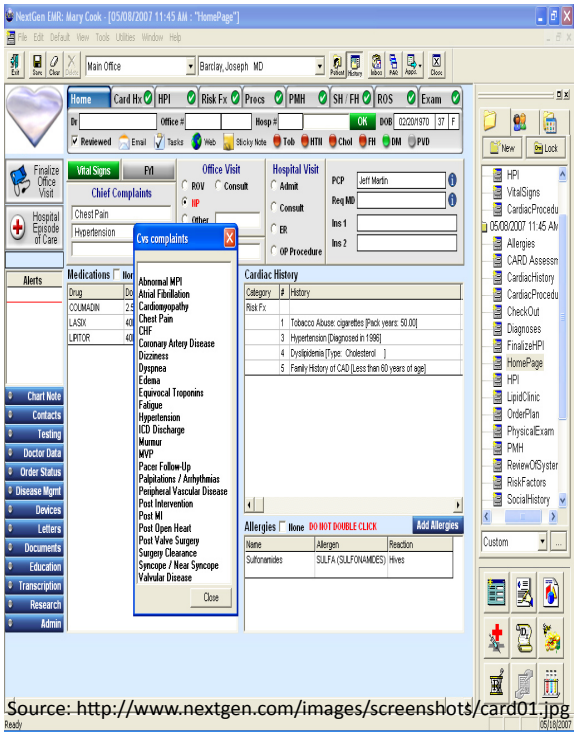
Previous EMR studies neglect the narrative

- Adoption
- Cost
- Economic value
- Quality of care metrics

- ***No previous study directly compares clinical communication using free dictations with clinical communication using EMRs.***

Mr. John Roe was seen in our office today in follow up of his paroxysmal atrial fibrillation. As you know, he is a 57 year old gentleman who had electrical cardioversion in May 2002 and had been maintained on Betapace since that time. His last visit in our office was July 23, 2003. He recently called our office in February stating he was back in atrial fibrillation which was documented on electrocardiogram. I elected to increase his Betapace to 160 mg twice a day and he did convert back to normal sinus rhythm. We had recommended Coumadin to him at that time but he did not start any Coumadin. He has done well since with no recurrence of arrhythmia and he is acutely aware of when he goes into the fibrillation. He denies any shortness of breath, chest discomfort of congestive heart failure symptoms and has otherwise felt quite well. His only medication is the Lexa pro 10 mg a day as an antidepressant and the Betapace. His review of systems is otherwise unchanged and negative.





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Clinically relevant information in dictation

Clinically relevant information in structured entry

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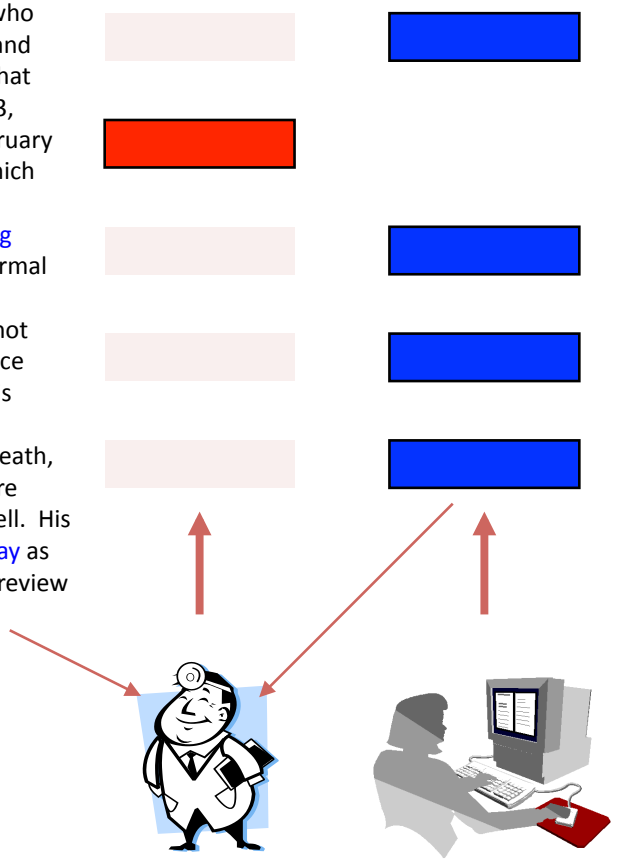

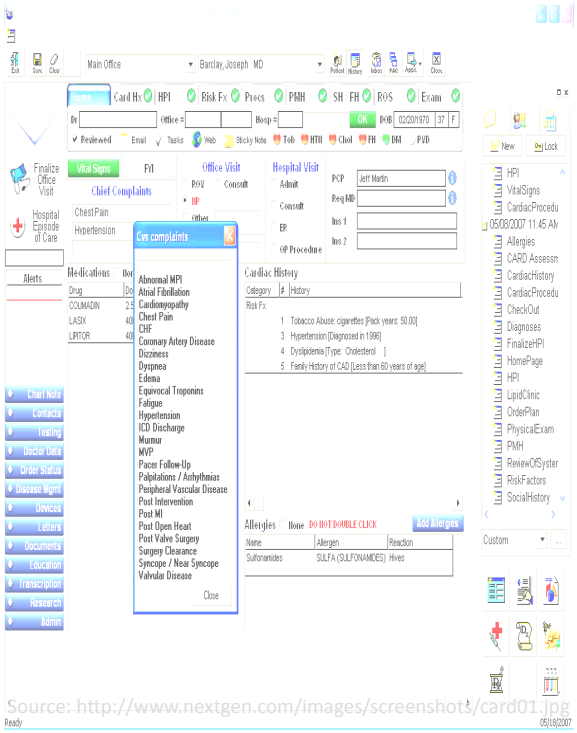

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Both experts

Considered an omission only if *both* experts identified it as an omission

Seriousness of omission	5	≥ 4	≥ 3
Percentage of documents	**0%**	**50%**	**85%**
Average omissions per document	**0**	**0.6**	**1.85**

- Some omissions seem straightforward to remediate with easy changes to the EMR specification, e.g.
  - Negative patient reports (“denies SOB”)
  - Degrees for symptoms (“mild/severe pain”)
  - Reactions to allergies (“rash/hives”)

Results, disregarding "remediable" omissions

Both experts

Considered an omission only if *both* experts identified it as an omission

Seriousness of omission	5	≥ 4	≥ 3
Percentage of documents	**0%**	**25%**	**50%**
Average omissions per document	**0**	**0.3**	**0.95**

- Other omissions seem difficult to remediate, even in principle
  - **Nuanced/detailed elaborations**
    - “almost brought to tears just in getting her up on the examination table”
    - “able to walk on flat levels and walk at a moderate pace for one hour without abnormal shortness of breath or chest pain”

- Other omissions seem difficult to remediate, even in principle
  - **Temporal/logical context**
    - ventricular tachycardia occurred “during post myocardial infarction care…far removed from the time of [patient’s] infarction”
    - the dictating physician was “hesitant to recommend [patient’s] FAA certification renewal” without a repeat of a previous catheterization

- Other omissions seem difficult to remediate, even in principle
  - **Dictating physician's thought process**
    - recommends continuing Toprol because it "seems to be controlling [the patient's] palpitations well"
    - considers discomfort to be "suggestive of angina"
    - believes that results of stress testing "would rule out significant major coronary artery disease, despite it being a somewhat incomplete study"

Difficult to remediate: the things that make the clinical narrative a *narrative*

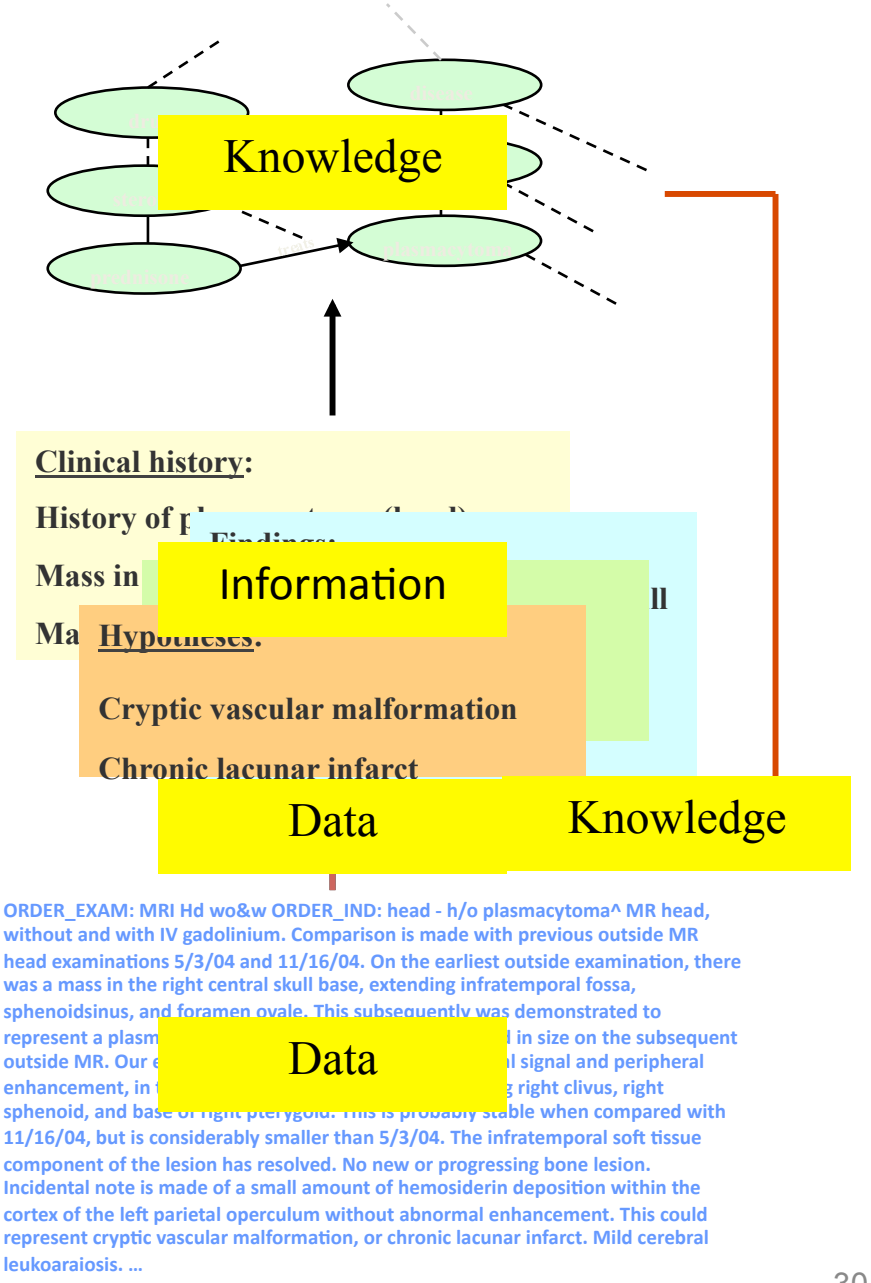
"…As EMRs proliferate, and increased Medicare scrutiny looms, **medical documentation is evolving from its original goal of recording what actually was going on with a patient, and what the provider was actually thinking, to sterile boilerplate documents** designed to justify the highest billing codes.

– "EMRs: Finding a balance between billing efficiency and patient care", Henry F. Smith, Jr., MD, Commentary, The Times Leader, Wilkes-Barre, PA, June 12, 2011.

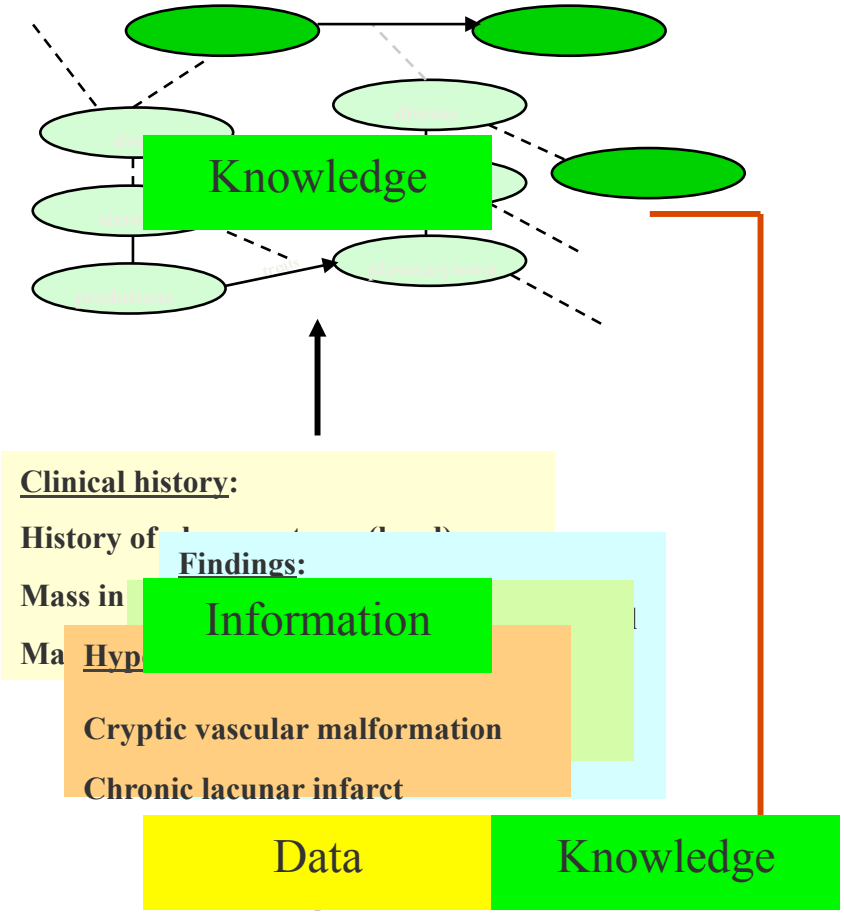
If you lose the language, you lose the story.

There’s another reason the language of the clinical narrative is a big deal.

- The process of knowledge discovery is a natural cycle
- At every iteration, information emerges from data by structuring and categorizing the data according to what we know *now*



- The process of knowledge discovery is a natural cycle
- At every iteration, information emerges from data by structuring and categorizing the data according to what we know *now*
- As we improve our knowledge, those structures and categories *change*

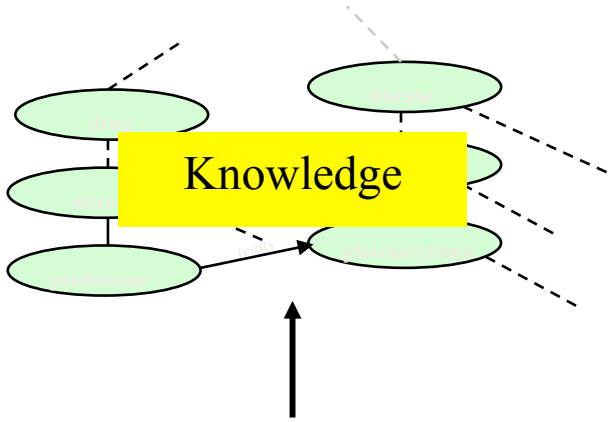


If the full clinical narrative never comes into existence, the knowledge discovery cycle is broken.

Clinical history:

Current medications:

NAME	DOSE	FRQ
melphalan	9 mg	QD
prednisone	100 mg	QD



Clinical history:

History of

Findings:

Mass in

Information

Cryptic vascular malformation

Chronic lacunar infarct

Without the original data, we can never reanalyze physicians' observations in the light of new knowledge and new categories.

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Current medications:

NAME	DOSE	FRQ
melphalan	9 mg	QD
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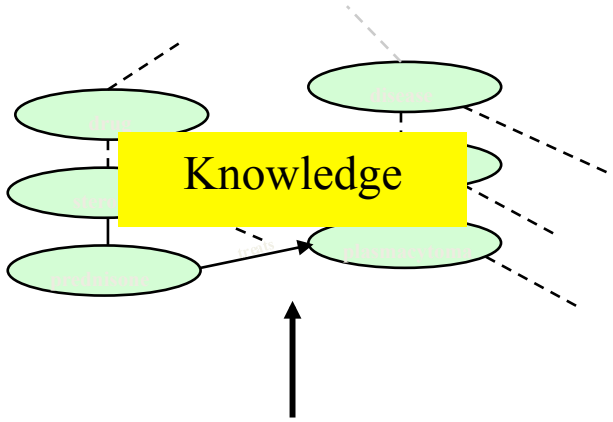

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Knowledge structures evolve *slowly*.

Current medications:

NAME	DOSE	FRQ
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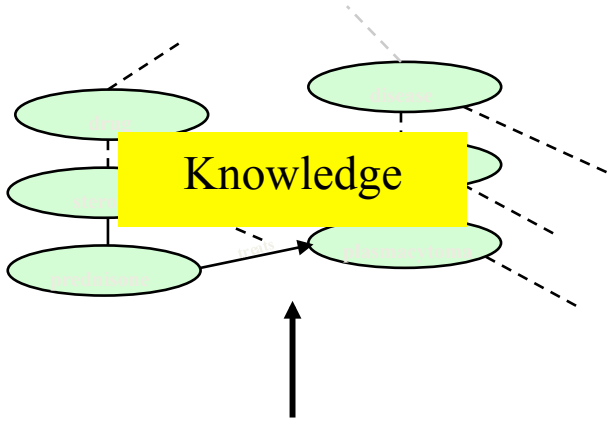

Clinical history:

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Example: *ground glass opacity*

Usage Period: term emerged with the introduction of 64-slice CT scans **around 1991**.

Definition: a hazy increase in lung attenuation through which pulmonary vessels may still be seen.

Clinical relevance: evidence that these are a much more probable indication of lung cancer than fully solid or fully non-solid nodules.

Appearance in standardized nomenclatures: MedDRA, **in 2001**.

Engeler, C., J. Tashjian, S. Trenkner, and J. Walsh. Ground Glass Opacity of the Lung Parenchyma: A Guide to Analysis with High-Resolution CT. *American Journal of Roentgenology 160 (1993): 249–251.*

A dilemma

- The future of healthcare depends on structured information we can aggregate and analyze.

- EMRs are widely viewed as the way to get there.

- But typical EMRs threaten to
  - eliminate or fragment crucial language in the record
  - omit information that clinicians need in order to communicate effectively
  - destroy the knowledge discovery cycle

Natural language processing (NLP) technology offers a way out of the dilemma.

Payers

Medical Coding

CPT (procedure codes)
ICD (diagnosis codes)

Billing

Transcription

ORDER_EXAM: MRI Hd wo&w ORDER_IND: head - h/o plasmacytoma^ MR head, without and with IV gadolinium. Comparison is made with previous outside…

Transcription

ORDER_EXAM: MRI Hd wo&w ORDER_IND: head - h/o plasmacytoma^ MR head, without and with IV gadolinium. Comparison is made with previous outside…

NLP Engine

Routing

Coder Review

Billing

Payers

delimit identify normalize extract predict apply_logic

HPI: Atrial fibrillation. This patient is a 56-year-old white gentleman who has had a history of atrial fib on and off since he had his bypass surgery. Patient was originally diagnosed with coronary artery disease as well as mitral valve problems approximately 3 years ago. Dr. used to take care of him at that time. He had a bypass surgery as well as mitral valve repair done at that time. Postop he had an episode of A-fib which then resolved spontaneously. He remembers somebody talking to him about cardioversion, but then the A-fib resolved spontaneously. So he was started on Coumadin. He would get some occasional episodes, but usually they are very brief, so he never bothered about them. Of late, over the last few months, he has been getting more frequent episodes and duration of these episodes is also prolonged for a few hours. So he saw Dr. who has referred him here for further evaluation and treatment. The patient states when he does get the A-fib, he feels very weak, tired, and short of breath. He denies any chest pain. Otherwise he is usually very active physically, he works fulltime as an electrician, and has not had any problems as far as doing his day-to-day work.
MEDICAL HISTORY: 1. Coronary artery disease as mentioned above. 2. Hypertension. 3. Hypercholesterolemia.
PAST SURGICAL HISTORY: Significant for hernia repair and appendectomy.
ALLERGIES: Morphine. **MEDICATIONS:** Toprol-XL 100 daily. Vytorin 10/40 one tablet daily. Coumadin as directed.
SOCIAL HISTORY: Smokes occasionally. Drinks alcohol very occasionally. Married, has 2 children.
FAMILY HISTORY: Father died from an MI. Mother died from lung cancer. One brother alive. He has had a history of a lung mass resected which was noncancerous. Another brother is alive and healthy.
ROS: Otherwise unremarkable. **EXAM: GENERAL:** He is alert and comfortable.
VITAL SIGNS: PULSE RATE: 72 and regular. BLOOD PRESSURE: 112/76. **WEIGHT:** 198 pounds.
HEENT: Pupils equal, reacting to light normally. Examination of the oral cavity is normal.
NECK: Good carotid upstroke bilaterally. No JVD.
CARDIAC: First and second sounds heard. Regular rate and rhythm. No gallops or murmurs.
LUNGS: Clear to auscultate.
ABDOMEN: Soft, nontender. No organomegaly.
DATA: Lab tests that are available reveal INR is therapeutic at 2.2. Chemistries are overall within the normal range. HDL cholesterol, however, is low at 34. LDL is 70.
IMPRESSION: Paroxysmal atrial fibrillation in a patient with prior mitral valve disease, currently having more frequent breakthroughs symptoms.
PLAN: I had a long discussion with the patient about the different treatment options including taking medications versus going for an ablation procedure. I did talk to him about the side effects of the antiarrhythmic drugs. Patient is somewhat leery of going on stronger medications. He wants to wait and see for awhile and if his symptomatology gets really bad, then he would be willing to consider more powerful medications. I do agree with him on that. Patient has not had any workup or any kind of a screening since he had his bypass surgery. So we will schedule him for exercise stress echo in the near future. With that information, if he does decide to go on antiarrhythmic drugs, then we can comfortably use class 1A or class 1C agents. Thank you for the consultation. We will keep you informed of the patient's progress.

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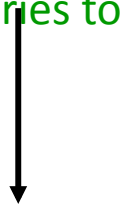
IMPRESSION: Paroxysmal atrial fibrillation in a patient with prior mitral valve disease, currently having more frequent breakthroughs symptoms.

Morphological analysis

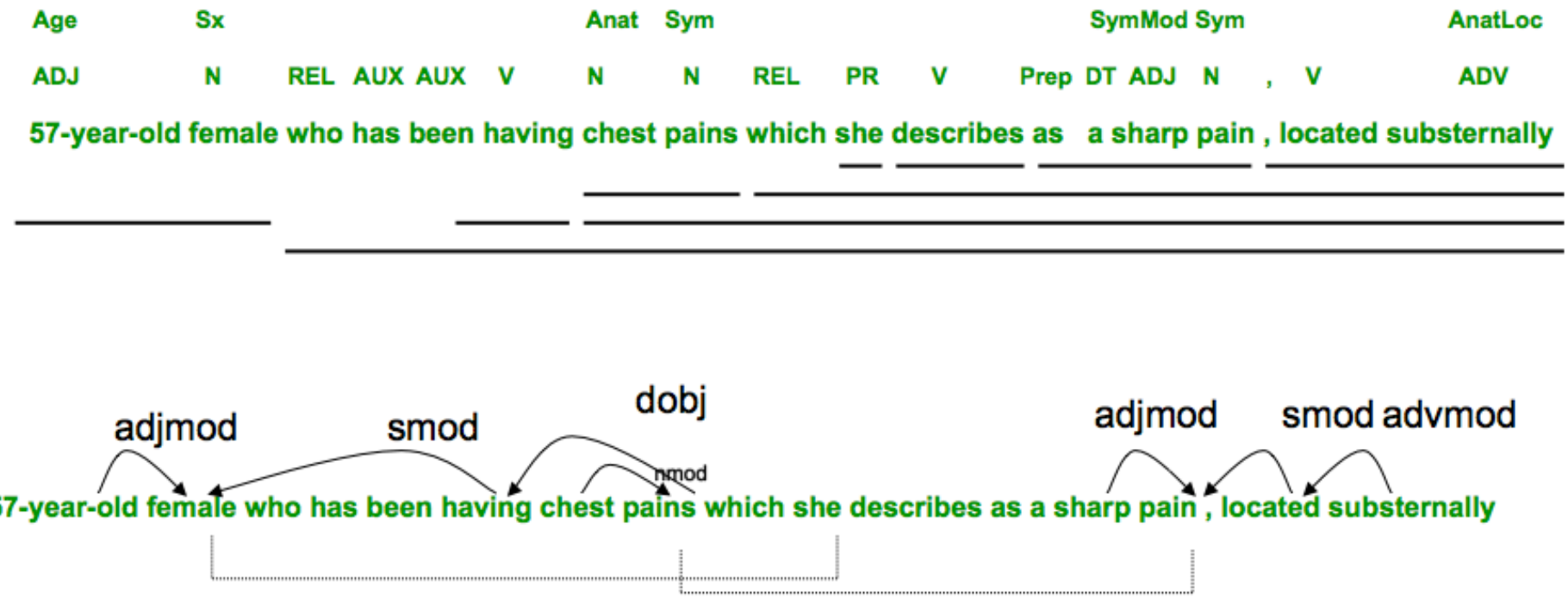
Mrs. Roe is a 57-year-old female who has been having chest pains which she describes as a sharp pain, located substernally occurring at night when she tries to lie on her right side.



= pain + PLURAL
In this context, *pains* is the same as *pain.*

Sometimes singular vs. plural matters, e.g. *cyst* is different from *cysts.*

Approaches to identifying/combining information units



delimit identify normalize extract predict apply_logic

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Type	Anatomy	Modifier	Diagnosis/Problem
-	atrial	-	fibrillation
history	atrial	-	fibrillation
-	mitral_valve	-	problem
-	-	-	weak
-	-	-	tired
-	-	-	short_of_breath
history	coronary_artery	-	disease
history	-	-	hypertension
-	-	-	hypercholesterolemia
-	atrial	paroxysmal	fibrillation
history	mitral_valve	-	disease

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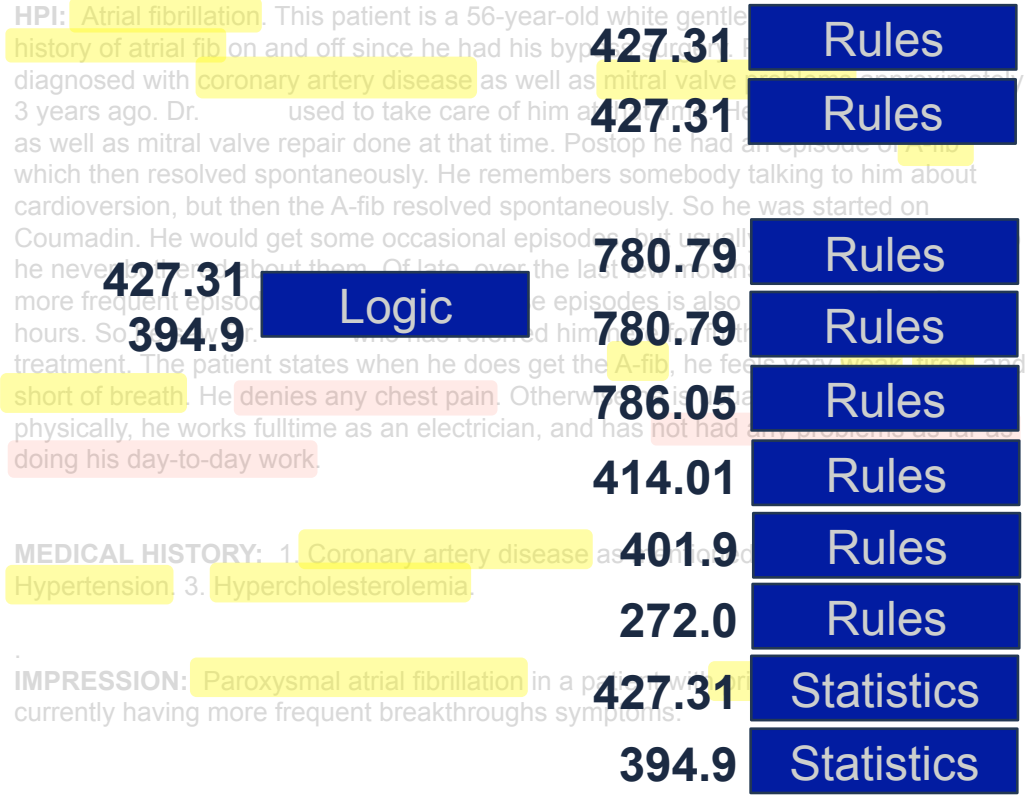
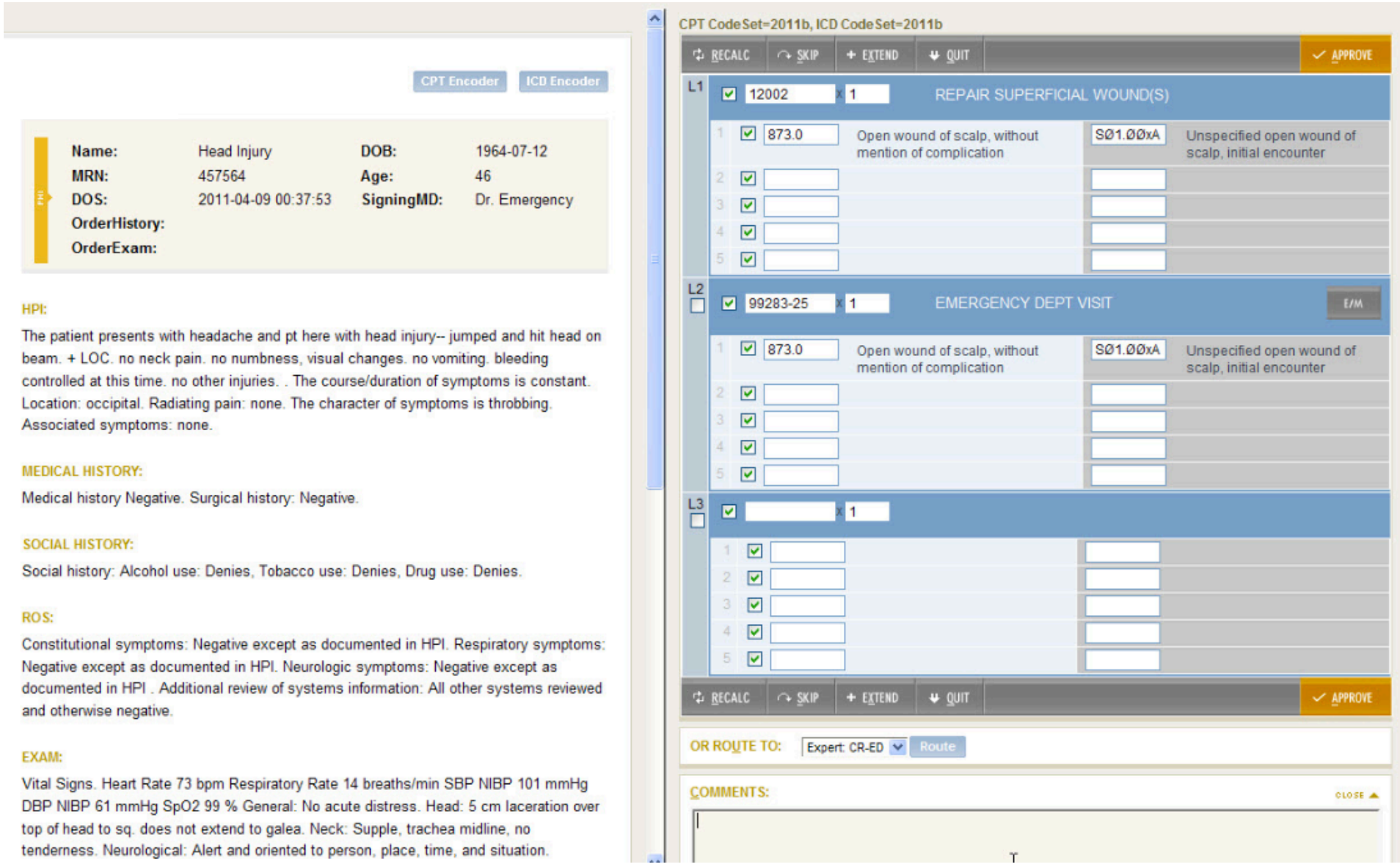
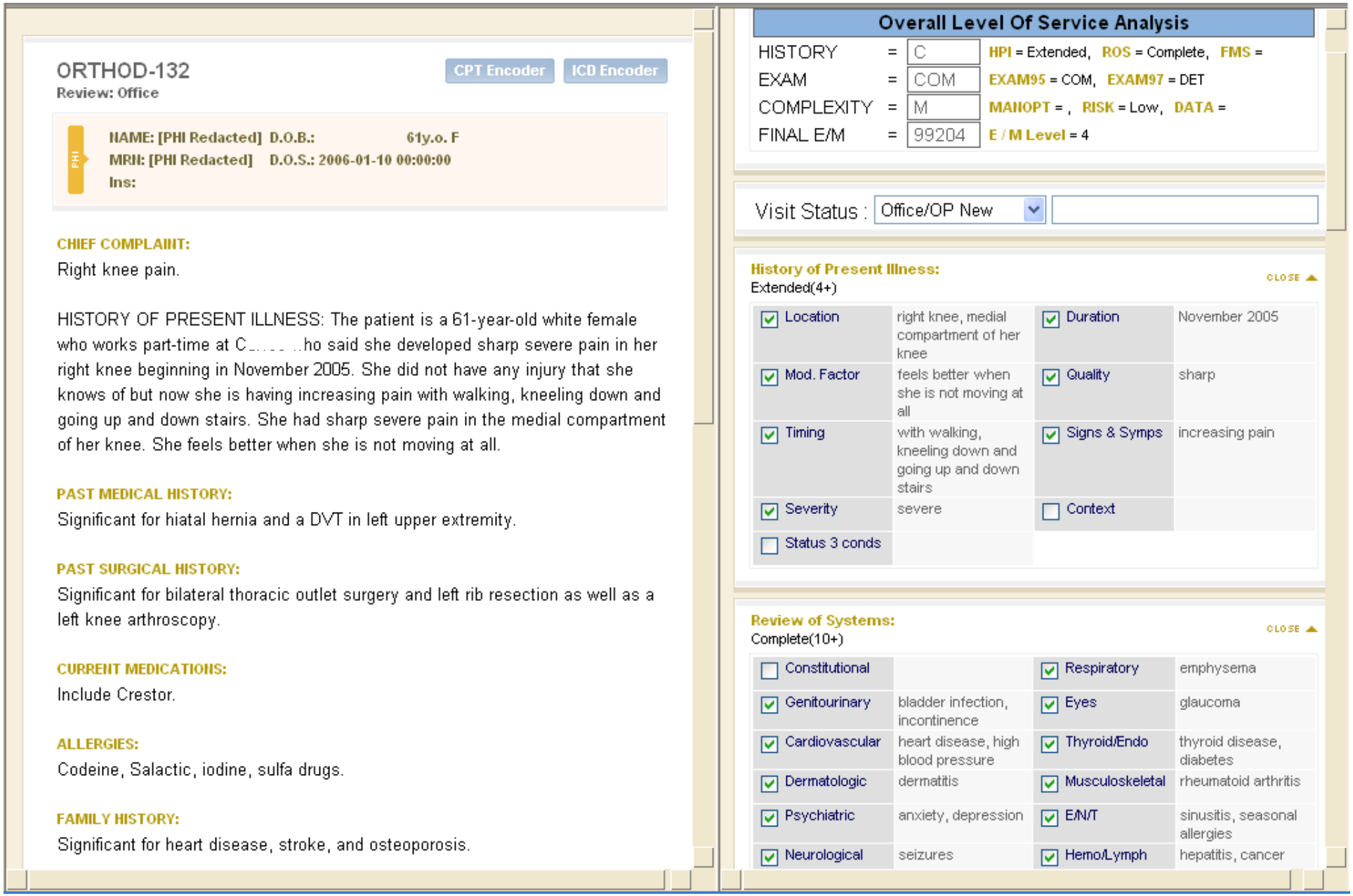


		Type	Anatomy	Modifier	Diagnosis/Problem
427.31	Rules	-	atrial	-	fibrillation
427.31	Rules	history	atrial	-	fibrillation
		-	mitral_valve	-	problem
780.79	Rules	-	-	-	weak
780.79	Rules	-	-	-	tired
786.05	Rules	-	-	-	short_of_breath
414.01	Rules	history	coronary_artery	-	disease
401.9	Rules	history	-	-	hypertension
272.0	Rules	-	-	-	hypercholesterolemia
427.31	Statistics	-	atrial	paroxysmal	fibrillation
394.9	Statistics	history	mitral_valve	-	disease

427.31, 394.9 → Logic


CPT Encoder
ICD Encoder
PHI
Name: Head Injury
DOB: 1964-07-12
MRN: 457564
Age: 46
DOS: 2011-04-09 00:37:53
SigningMD: Dr. Emergency
OrderHistory:
OrderExam:
HPI:
The patient presents with headache and pt here with head injury-- jumped and hit head on beam. + LOC. no neck pain. no numbness, visual changes. no vomiting. bleeding controlled at this time. no other injuries. . The course/duration of symptoms is constant. Location: occipital. Radiating pain: none. The character of symptoms is throbbing. Associated symptoms: none.
MEDICAL HISTORY:
Medical history Negative. Surgical history: Negative.
SOCIAL HISTORY:
Social history: Alcohol use: Denies, Tobacco use: Denies, Drug use: Denies.
ROS:
Constitutional symptoms: Negative except as documented in HPI. Respiratory symptoms: Negative except as documented in HPI. Neurologic symptoms: Negative except as documented in HPI . Additional review of systems information: All other systems reviewed and otherwise negative.
EXAM:
Vital Signs. Heart Rate 73 bpm Respiratory Rate 14 breaths/min SBP NIBP 101 mmHg DBP NIBP 61 mmHg SpO2 99 % General: No acute distress. Head: 5 cm laceration over top of head to sq. does not extend to galea. Neck: Supple, trachea midline, no tenderness. Neurological: Alert and oriented to person, place, time, and situation.
CPT CodeSet=2011b, ICD CodeSet=2011b
RECALC
SKIP
EXTEND
QUIT
APPROVE
L1
12002
1
REPAIR SUPERFICIAL WOUND(S)
873.0
Open wound of scalp, without mention of complication
SØ1.ØØxA
Unspecified open wound of scalp, initial encounter
L2
99283-25
EMERGENCY DEPT VISIT
E/M
L3
OR ROUTE TO:
Expert: CR-ED
Route
COMMENTS:
CLOSE


ORTHOD-132
Review: Office
CPT Encoder
ICD Encoder
PHI
NAME: [PHI Redacted] D.O.B.: 61y.o. F
MRN: [PHI Redacted] D.O.S.: 2006-01-10 00:00:00
Ins:
CHIEF COMPLAINT:
Right knee pain.
HISTORY OF PRESENT ILLNESS: The patient is a 61-year-old white female who works part-time at C_____ ..ho said she developed sharp severe pain in her right knee beginning in November 2005. She did not have any injury that she knows of but now she is having increasing pain with walking, kneeling down and going up and down stairs. She had sharp severe pain in the medial compartment of her knee. She feels better when she is not moving at all.
PAST MEDICAL HISTORY:
Significant for hiatal hernia and a DVT in left upper extremity.
PAST SURGICAL HISTORY:
Significant for bilateral thoracic outlet surgery and left rib resection as well as a left knee arthroscopy.
CURRENT MEDICATIONS:
Include Crestor.
ALLERGIES:
Codeine, Salactic, iodine, sulfa drugs.
FAMILY HISTORY:
Significant for heart disease, stroke, and osteoporosis.
Overall Level Of Service Analysis
HISTORY = C HPI = Extended, ROS = Complete, FMS =
EXAM = COM EXAM95 = COM, EXAM97 = DET
COMPLEXITY = M MANOPT = , RISK = Low, DATA =
FINAL E/M = 99204 E / M Level = 4
Visit Status : Office/OP New
History of Present Illness:
Extended(4+)
CLOSE
Location right knee, medial compartment of her knee
Duration November 2005
Mod. Factor feels better when she is not moving at all
Quality sharp
Timing with walking, kneeling down and going up and down stairs
Signs & Symps increasing pain
Severity severe
Context
Status 3 conds
Review of Systems:
Complete(10+)
CLOSE
Constitutional
Respiratory emphysema
Genitourinary bladder infection, incontinence
Eyes glaucoma
Cardiovascular heart disease, high blood pressure
Thyroid/Endo thyroid disease, diabetes
Dermatologic dermatitis
Musculoskeletal rheumatoid arthritis
Psychiatric anxiety, depression
E/N/T sinusitis, seasonal allergies
Neurological seizures
Hemo/Lymph hepatitis, cancer

IR **D.O.B.**: [PHI REDACTED] **Age**: 37
NAME: [PHI Redacted] **D.O.S.**: 2007-10-23 12:06:00 **Gender**: M
SSN: [PHI Redacted] **Attending**: null
Referred By: **Signed By**: null

[1: 203444515] Angiography Carotid Cervical Unilateral [2: 203445682] Angiography Vertebral Cervical Intracranial Unilateral [3: 203445689] Angiography Internal Carotid or Cerebral Unilateral [4: 203445699] Angiography Carotid External Unilateral

Neurointerventional procedure

Cerebral angiogram, 4/24/2006

Indication: Spontaneous subdural hematoma

Physicians: 1. Dr. Joh

Vessels studied: 1. Left internal carotid artery injection, PA, lateral, RAO, LAO projections, intracranial. 2. Left external carotid artery injection, PA, lateral projections, intracranial. 3. Left vertebral artery injection, PA, lateral projections, intracranial. 4. Right common carotid artery injection, PA, lateral projections, intracranial.

Discussion: Angiographic examination of the above vessels was performed after consent was obtained. A 5 French catheter was placed in the right common femoral artery, using the Seldinger technique, after Betadine prep and local anesthesia with lidocaine. After the procedure, the catheter was removed and hemostasis achieved at the puncture site.

Findings: Left internal carotid artery: There is subdural mass-effect over the left cerebral convexity manifest by displacement of pial vessels and cortical veins away from the inner table of the skull. There is rightward shift of the anterior cerebral artery complex. There are no arterial or venous vascular abnormalities.

Left external carotid artery: There are no dural vascular abnormalities.

Left vertebral artery: There is medial displacement of the left posterior cerebral artery complex. No vascular abnormalities are identified.

Right common carotid artery: There are no cerebral or dural vascular abnormalities.

Impression: Left convexity mass-effect consistent with known subdural hematoma. Negative cerebral angiogram.

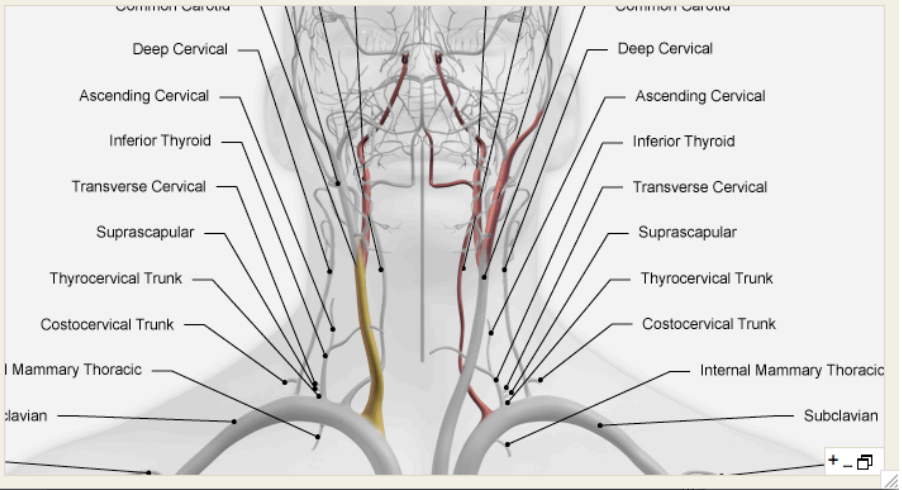
CPT CodeSet=2007d, ICD CodeSet=2007a

RECALC | SKIP | APPROVE

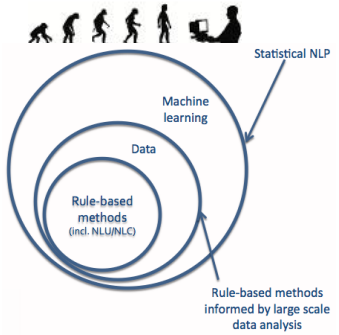
	ICD Code	Description
I1	348.4	Compression of brain
I2	432.1	Subdural hemorrhage
+		Add ICD Code

APPROACH: FEMORAL

	Side	Procedure / Vessel	Type	Filter	CPT Codes	ICD Codes
L1	Left	Internal Carotid	CATH	None	36216	348.4 432.1
L2	Left	Vertebral	CATH	None	36216-59	348.4 432.1
L3	Right	Common Carotid	CATH	None	36216-59	348.4 432.1
L4	Left	External Carotid	CATH	Family	36218	348.4 432.1
L5	Bilat	Internal Carotid	S+I	None	75671	348.4 432.1



Natural language processing and machine learning



Clinical data

Subject matter expertise

NLP-enabled aggregate analysis

Category	Sample Measures
(A) Patient Identification & Recruitment	Male smokers, 50 y.o.+ with history of COPD and no history of lung cancer for enrollment in a clinical trial/study
(B) Performance & Accreditation	Patients with diabetes and their most recent HbA1C<9.0%
(C) Acute Care Management	% of patients aged 5-40y.o. with asthma prescribed an inhaled corticosteroid
(D) Chronic Care Management	% of patients with Rheumatoid Arthritis prescribed a DMARD
(E) Utilization	Hospital readmission rates within 30 days after discharge

NLP-enabled aggregate analysis

Category	Sample Measures
(F) Complications & Patient Safety	Urinary catheter removal on post-operative day 1 or 2
(G) Provider Profiling	% of primary care MDs not prescribing Beta-Blocker Rxs for patients with left sided heart failure (LVSD)
(H) Revenue Cycle Support & Efficiency	Specialist referral rates outside of the physician group or network (i.e. leakage)
(I) Customized Applications	The number of patients with hypertension discharged from the hospital on < 2 antihypertensive Rxs

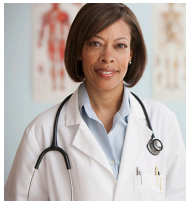
We can get where we need to go without losing the language.

A way forward: recognizing that structured datasets ≠ structured input


Patients
Researchers


Clinicians
Policy makers


Informed by the best current knowledge and data, language technology transforms clinical language into standardized, interoperable, available information.


Transcription

Physicians focus on the care of the patient and communicate unimpeded, full, narrative clinical data.

NLP Engine

Both health information technology and medical communities of practice inform, and are informed by, evolving medical knowledge.

Save the cheerleader, save the world

Save the **narrative**, save the world

Thank you.

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